

City of Sioux Falls

Supplemental Standard Specifications

for

Water Main Construction

Section 300

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1.0 GENERAL

1.1 SCOPE OF WORK

The Contractor shall furnish all the necessary labor, materials, equipment, tools and supplies that are necessary to install a complete water main system, as shown on the plans and/or called for in these specifications or its addenda. It is the intent of these specifications to install a complete system or job.

1.2 TERM OF WARRANTY

Reference Section 500 – Warranty for Construction Activity.

1.3 QUALITY CONTROL AND SUBMITTALS

Retesting of work required because of nonconformance to the specified requirements shall be performed by the same independent firm on the instructions of the Engineer. Payment for retesting performed during the contract period and during the warranty period will be charged to and will be the responsibility of the Contractor.

Shop drawings and data shall be submitted for, but not be limited to, the following items:

Fire hydrants, pipe, pipe fittings, bedding material, stabilization material, granular material, and any other pertinent information concerning construction materials that the Engineer deems necessary for the review of the materials used on the project in accordance with the specifications and drawings.

The Contractor shall submit the number of copies that the Contract requires plus three copies which the Engineer will retain. The Contractor shall obtain shop drawing approval before any of the work related to that material is performed.

1.4 BIDS

Unless a lump sum is called for, bids shall be received on a unit price basis.

The unit price bid per lineal foot for water main shall include the complete construction with the tracer wire system and other items as specified, including trench dewatering when necessary. The lineal footage will be determined by measuring from the center of one fitting or valve to the center of the next fitting or valve. When PVC pipe is used, the price bid shall include the cost of encasing the fittings in polyethylene. When ductile iron pipe is used, the price bid shall include the cost of encasing the fittings and the pipe in polyethylene.

The unit price bid per cubic yard for rock excavation shall include all permits, labor, tools, equipment, explosives, protective mats, disposal of rock, and replacement backfill material.

1.5 PAYMENT

Payments to the Contractor shall be made in accordance with the General Conditions.

1.6 ACCEPTANCE

Acceptance of the work shall be in accordance with the General Conditions.

2.0 MATERIALS

2.1 WATER MAIN PIPE

Water main pipe and service lines 4 inches in diameter and greater shall be Ductile Iron or Poly Vinyl Chloride (PVC) with a push on joint. Pipe shall sustain a working pressure of 150 pounds per square inch (psi) with a minimum cover of 6 feet. Pipe classes shall be as follows:

Pipe Size (Inches)	Ductile Iron Thickness Class	PVC
4	52	C900 DR 18
6	52	C900 DR 18
8	50	C900 DR 18
12	50	C900 DR 18
16	50	Not Allowed
20	50	Not Allowed
24	50	Not Allowed

Ductile Iron

Ductile iron pipe shall meet the requirements of AWWA C150 and C151 and be lined with cement mortar in accordance with AWWA C104. Ductile iron pipe shall be coated on the outside with a 1-mil thick asphaltic coating. Rubber gasket joints for ductile iron pipe shall meet the requirements of AWWA C111.

PVC

PVC pipe shall meet the requirements of AWWA C900. Sealing pipe joints for PVC pipe shall use the Rieber joining system, which has the gasket formed into the pipe during the manufacturing process.

2.2 WATER MAIN FITTINGS

Fitting types applicable to this specification consist of bends, crosses, tees, reducers, plugs, caps, and sleeves. Ductile iron fittings shall meet the requirements of AWWA C110 or C153, with a minimum working pressure of 250 psi. Ductile iron fittings shall be mechanical joint meeting the requirements of AWWA C111, except as noted. Fittings shall be bid complete with gaskets, glands, bolts, and nuts. Bolts shall be fluorocarbon coated cor-ten steel t-bolts and nuts equal to NSS cor-blue or approved equal low alloy corrosion-resistant high-strength steel in accordance with ANSI/AWWA C111/A21.11. Fittings shall be lined with cement mortar in accordance with AWWA C104 and coated on the outside with a 1-mil thick asphaltic coating. Slip joint plugs are required to have "ears."

Acceptable manufacturers are American, Griffin, Sigma, Star, Tyler/Union, and U.S. Pipe.

2.3 MECHANICAL JOINT RESTRAINER DEVICES

Restraining mechanisms shall provide wedges or full circle contact and support of the pipe wall. Restraint shall be accomplished by a series of ring or wedge segments mechanically retained inside the gland housing and designed to grip the pipe wall in an even and uniform manner. Restraining devices shall be actuated by bolts featuring twist off heads to ensure proper installation torque is applied. All components of the restrainer, including the gland, bolts, and restraint segments, shall be of high-strength ductile iron, ASTM A536. Bolts shall be fluorocarbon coated cor-ten steel t-bolts and nuts equal to NSS cor-blue or approved equal low alloy corrosion-resistant high-strength steel in accordance with ANSI/AWWA C111/A21.11. Appropriate restrainer devices shall be supplied for the specific type of piping material being used on the project.

Restrainer devices shall be MEGALUG® by EBBA Iron, Uni-Flange® by The Ford Meter Box Company, Stargrip® by Star, or One Lok™ by Sigma. Restrainer devices for Ductile Iron Pipe can be Romac Industries “Romagrip.”

2.4 VALVES

Valves 4 inches through 12 inches shall be gate valves and valves 16 inches and larger shall be butterfly valves.

Gate and Tapping Valves

Gate and tapping valves shall meet the requirements of AWWA C509 or C515 and have a pressure rating of 250 psi. Valves shall be resilient seated and ferrous components shall be ductile iron. Gate valves shall be mechanical joint meeting the requirements of AWWA C111 and tapping valves shall have a mechanical joint end and a flanged end to correspond to the branch flange of the tapping sleeve. Bolts shall be fluorocarbon coated cor-ten steel t-bolts and nuts equal to NSS cor-blue or approved equal low alloy corrosion-resistant high-strength steel in accordance with ANSI/AWWA C111/A21.11.

All internal and external ferrous surfaces shall have a fusion bonded epoxy coating applied electrostatically prior to assembly meeting the requirements of AWWA 550. Valves shall have a ductile iron wedge encapsulated with nitrile rubber or an EPDM rubber compound. Stems shall be nonrising, bronze or stainless steel, and shall be sealed by three o-rings. Valves shall have a 2-inch ductile iron operating nut and open right (clockwise). Bonnet and stuffing box bolts shall be stainless steel. Resilient seats shall be bonded or mechanically attached to the gate.

Acceptable manufacturers are American Flow Control, American AVK, and Clow/Kennedy/M&H, or an approved equal.

Butterfly Valves

Butterfly valves shall meet the requirements of AWWA C504, Class 150B for buried installation. Valves shall be the short body type, tight closing, have a pressure rating of 150 psi, and have mechanical joint ends meeting requirements of AWWA C111. Bolts

shall be fluorocarbon coated cor-ten steel t-bolts and nuts equal to NSS cor-blue or approved equal low alloy corrosion-resistant high-strength steel in accordance with ANSI/AWWA C111/A21.11. Valve body and disc shall be cast or ductile iron. The disc shall have a stainless steel edge and seat at 90 degrees to the pipe axis. The shaft shall be stainless steel. The seat shall be located in the valve body and be Buna-N. Valves shall be complete with a manual operator and a 2-inch square operating nut suitable for buried service. Valves shall open right (clockwise).

Acceptable manufacturers are DeZURIK, M&H/Clow, Mueller, and Pratt.

2.5 FIRE HYDRANTS

Fire hydrants shall be dry barrel and meet the requirements of AWWA C502. The rated working pressure shall be 250 psi and the rated test pressure shall be 500 psi. The nozzle section, upper and lower barrels, and the hydrant base shall be ductile or gray iron. The main valve closure shall be of the compression type, opening against the pressure and closing with the pressure. The main valve opening shall not be less than 5¼ inches and be designed so that removal of all working parts can be accomplished without excavating.

The bronze seat shall be threaded into mating threads of bronze for easy field repair. The draining system of the hydrant shall be bronze and be positively activated by the main operating rod. All threads shall be National Standard threads. Internal travel stop nut shall be bronze or zinc plated steel. Hydrant operating threads to be factory lubricated and sealed from the waterway with o-rings. Operating nuts shall be pentagon shaped and measure 1½ inches point to flat. Hydrants shall open right (clockwise).

Hydrants shall have a 6-inch mechanical joint inlet and the barrel shall be sized for a trench depth of 7 feet. Hydrants shall have two 2½-inch hose nozzles and one 4½-inch pumper nozzle, all located on the same horizontal plane. The centerline of the nozzles shall be a minimum of 18 inches above the ground line groove. Nozzle cap nuts shall be the same dimension and shape as the operating nuts described above, and the nozzle caps shall be furnished with security chains. The section of the hydrant above ground shall be painted Sioux Falls yellow. Hydrants shall be capable of being extended in 6-inch increments and shall be equipped with traffic features that include a breakaway flange and stem with a shaft coupling.

All buried body parts are to be 304 Stainless steel. Bolts shall be fluorocarbon coated cor-ten steel t-bolts and nuts equal to NSS cor-blue or approved equal low alloy corrosion-resistant high-strength steel in accordance with ANSI/AWWA C111/A21.11

Fire hydrants shall be the Waterous Pacer WB-67-250 by American Flow Control, the American-Darling B-84-B by American Flow Control, or the Series 2700 by American AVK.

2.6 VALVE BOXES

Valve boxes shall be cast iron and screw-type adjustable with a 5¼-inch shaft. Lids shall be standard drop type labeled "WATER" with a 1½-inch long skirt.

Valve boxes shall be the 6850 Series or the 6860 Series by Tyler or an approved equal. The 6850 Series shall be the 666-S box and shall be installed with a valve box adaptor. Valve box adaptors shall be the Valve Box Adaptor II by Adaptor Inc. or an approved equal. The 6860 Series shall be the DD box with a #6 base.

2.7 TRACER WIRE

The components of the tracer wire system shall be suitable for direct bury applications. The conductor shall be 12 AWG, solid-strand, soft-drawn copper per ASTM B-3. The conductor shall be insulated with high molecular weight polyethylene. The minimum insulation thickness shall be 0.045 inches and the color shall be blue. Splices and/or connectors shall be capable of handling from two to four wires per connection and be designated at "water proof." Ground rods shall be a 3/8-inch diameter, 60-inch-long steel rod uniformly coated with metallically bonded electrolytic copper. Ground rod clamps shall be a high-strength, corrosion-resistant copper alloy.

Acceptable manufacturers of the tracer wire are Coleman Cable, Kris-Tech Wire, or an approved equal. Splice kits/connectors shall be Scotchlok™ DBY by 3M, LV 9000 by SNAPLOC™, or an approved equal.

2.8 INSULATION

Water main insulation shall be an extruded polystyrene board and meet the requirements of ASTM C578, Type IV. The minimum R-value shall be 5.0 as determined by ASTM C518. The minimum compressive strength shall be 25 psi as determined by ASTM D1621. The maximum water absorption shall be 0.1 percent by volume as determined by ASTM C272. The maximum water vapor permeance shall be 1.1 perm as determined by ASTM E96.

Water main insulation shall be STYROFOAM™ Square Edge by the Dow Chemical Company, STYROFOAM™ Brand Scoreboard by the Dow Chemical Company, or an approved equal.

2.9 CASING PIPE SPACERS AND END SEALS

Casing spacers shall be Model SSI-8 for carrier pipes 24 inches in diameter and smaller and Model SSI-12-2 for carrier pipes 30 inches in diameter and greater as manufactured by Advance Products & Systems, Inc., Lafayette, Louisiana, or an approved equal. Casing spacers shall be constructed of circular T-304 stainless steel segments, which bolt together forming a shell around the carrier pipe. The spacers shall be designed with risers (when needed) and runners to support and center the carrier pipe within the casing pipe and maintain a minimum clearance of 1 inch between the casing pipe inside diameter (ID) and the spacer outside diameter (OD). On carrier pipes

with an OD of 16 inches or less, each spacer shall have four riser/runner combinations—two on each half. On carrier pipes with an OD of 20 inches and greater, the number of riser/runner combinations shall be as recommend by the manufacturer, with four being the minimum. T-304 stainless steel bolts and nuts shall be supplied with the spacers.

The band shall be manufactured of 8-inch (SSI-8) or 12-inch (SSI-12-2) wide, 14 gauge T-304 stainless steel. The risers shall be constructed of T-304 stainless steel having a minimum length of 6 inches (SSI-8) or 10 inches (SSI-12-2). Abrasion-resistant runners, having a minimum length of 7 inches (SSI-8) or 11 inches (SSI-12-2), and a minimum width of 2 inches, shall be attached to each riser to minimize friction between the casing pipe and the carrier pipe as it is installed. Runner material shall be of glass reinforced plastic with the following minimum properties: compression strength of 25,000 psi, flexural strength of 32,000 psi, and tensile strength of 22,000 psi. The ends of all runners shall be beveled to facilitate installation over rough weld beads or the welded ends of misaligned or deformed casing pipe.

Interior surfaces of the stainless steel shell shall be lined with EPDM having a minimum thickness of 0.090 inches with a hardness of durometer “A” 85-90. Placement of the spacers shall be a maximum of one foot on each side of the bell joint and one every 6–8 feet thereafter. End seals shall be Model AW Wraparound casing end seals as manufactured by Advance Products & Systems, Inc., Lafayette, Louisiana, or an approved equal. Full conical-shaped wraparound seals made of 1/8-inch-thick neoprene rubber shall be provided for each end of the casing pipe. T-304 stainless steel banding straps with a 100 percent nonmagnetic worm gear mechanism and pressure sensitive butyl mastic strips shall be provided to seal edges.

2.10 SELECT FILL AND WATER MAIN BEDDING

The material for select fill and water main bedding shall be minus 1 inch with not more than 10 percent passing the No. 200 sieve. The select fill will be bid per ton and will only be used on a limited basis for replacement material to aid in gaining acceptable trench compaction. Water main bedding material will be used for both PVC and ductile iron water main.

2.11 TRENCH STABILIZATION MATERIAL

The material for trench stabilization shall consist of ¾- to 4-inch crushed angular, well-graded material. Larger material may be used if necessary to stabilize the bottom of the trench. The trench stabilization material will be used as directed by the Engineer. The use of trench stabilization material will not eliminate the need for water main bedding material.

2.12 VALVE BOX MARKERS

Valve box markers shall be a minimum of 3¾ inches wide and 78 inches in length. The markers shall be blue in color. The markers shall be ultraviolet resistant and stable in all weather conditions. The markers shall be Composite Composition Utility Markers as

manufactured by Carsonite International or approved equal. The markers shall be labeled "CAUTION WATER PIPELINE—CALL BEFORE DIGGING."

2.13 WATER SERVICE LINES

Water service lines 2 inches in diameter and smaller shall be U.S. Government Type K soft copper tubing or polyethylene pressure pipe. Tubing material for Type K soft copper shall be 1¼ inches in diameter and smaller shall be supplied in 60-foot single or double pancake coils, with the minimum diameter of the center coil to be 16 inches. Tubing material for Type K soft copper 1½ inches in diameter and greater shall be supplied in 20-foot lengths with the ends of the tubing cut off evenly. Fittings and valves shall meet the requirements of AWWA C800 and ASTM B62 for Type K soft copper. Polyethylene service tubing may be used for services 2 inches and smaller and shall meet the requirements of AWWA C901-95 for pipe and fittings

Approved manufacturers of copper tubing are Cerro, Mueller, Halstead, and Wolverine. Approved manufacturers of polyethylene tubing are Parr-Excel PE Cresline Plastic Pipe Co. Industries, Inc, and Endot Industries, Inc, AWWA C901 200 PSI, SDR-7 (IPS).

Water service lines 4 inches in diameter and greater shall be ductile iron or C900 PVC pipe as specified in Section 2.1. Water service lines greater than 2 inches in diameter that extend vertically through building floors shall be ductile iron pipe as specified in Section 2.1.

3.0 CONSTRUCTION REQUIREMENTS

3.1 INTERRUPTION OF SERVICE

No valve or other control on the existing water distribution system shall be operated for any purpose by the Contractor. The Contractor shall notify all consumers affected by any interruption of water service at least 24 hours before the interruption of water service. Consumers shall be verbally notified when possible. In the event a consumer cannot be verbally notified, the Contractor shall secure a door hanger provided by City Engineering to the most frequently used entrance. The Contractor shall initiate valve operation requests with the City Engineering Department.

3.2 ALIGNMENT

The Engineer will stake all water main alignment and inspect all water main installation. **All fittings, valves, hydrant extensions, etc., will be left open until inspected and measured by the Engineer.** When necessary, the Engineer will provide grade stakes for alignment. The Contractor shall carry line and grade into the trench by means of approved survey methods.

At no time shall the Contractor or his employees change the grade without approval of the Engineer. If underground interference is encountered at the assigned grade, the Contractor shall notify the Engineer for alternate alignment.

The Contractor shall furnish help when requested to stake and measure water main.

3.3 UNDERGROUND INTERFERENCE

The location of existing underground public or private utilities may be shown on the plans, as reported by the various utility companies and the City of Sioux Falls, but this does not relieve the Contractor of the responsibility of determining the accuracy or completeness of said locations. The Contractor shall determine the location of all underground ducts, conduits, pipes, or structures which will be affected by the work, and shall take steps necessary to support, protect, remove, or relocate said structures by any means suitable to the owners of the structure involved and the Engineer. In those instances where their relocation or reconstruction is impracticable, a deviation from line and grade may be ordered by the Engineer. The Contractor shall be responsible for notifying the various utility companies if the Contractor's work will expose, affect, or endanger any existing utility. All cost of investigation and any necessary protection, support, removal, or relocation of said structures shall be included in the contract bid price for installing water main unless specifically provided for in the bid items. The Contractor shall not begin construction until all utility companies have been contacted and their respective underground utilities have been located and marked.

The bid item "locating utilities" will be used to locate water lines only if the service location marked exceeds the actual service location by 4 feet in either direction and additional excavation is required. The bid item "verify utilities" will be used only when it is necessary to excavate down to the utility to determine if any vertical and/or horizontal

conflicts exist between existing utilities and the proposed new water lines to be installed as shown on the plans. All costs of other exploratory investigation/excavation necessary for determining the location and depth of utilities shall be included in the contract bid price for installing pipe.

3.4 EXCAVATION

Trenches shall be excavated on lines furnished by the Engineer. Excavation shall be classed as either rock or earth excavation. Rock excavation shall consist of solid rock lying in its natural bed which requires fracturing for its removal, as defined under "Rock Excavation," and boulders one cubic yard in volume or greater. All other materials shall be classed as earth excavation.

Rock Excavation

All rock excavation shall be under one classification. It shall include solid ledge rock in its natural location that requires systematic quarrying, drilling, and/or blasting for its removal and boulders one cubic yard in volume or greater.

When rock is encountered in the trench, it shall be stripped of earth and the Engineer shall be notified by the Contractor and given ample time to make a profile thereof, before removal operation begins, to determine quantities. Prior to installing water main through a rock excavation, a 6-inch cushion of bedding material will be placed to protect the pipe.

Procedures for rock removal operations shall be subject to the approval of the Engineer. The use of explosives shall be limited to the magnitude of the charge that will not cause damage to the adjoining property through shock vibrations or other stress loadings. In addition, the Contractor shall provide adequate protection to ensure that there will not be fragments of rock or other debris flying through the air when discharging explosives. The entire rock removal operation shall be the responsibility of the Contractor and the Contractor shall pay for any damage caused by the rock removal operations. Adequate insurance protection, in addition to the standard liability insurance required, shall be purchased by the Contractor for payment of any damage that may be caused by the use of explosives. Explosive permits must be obtained from the City of Sioux Falls Fire Rescue as per City ordinance.

Earth Excavation

Water mains shall be installed using the open cut method, except that where conditions warrant, the Engineer may permit the use of short tunnels. In unstable soil, the trench shall be supported by shoring or sheeting as required to prevent caving. Sheeting shall be withdrawn after the pipe has been properly covered.

Wherever, in the opinion of the Engineer, the bottom of the trench does not afford a reliable or suitable foundation, the trench shall be excavated to such additional depth as is required and replaced with trench stabilization material. Pipe bedding material will always be required in addition to trench stabilization material.

3.5 SHEETING AND BRACING

If City, state, or federal regulations dictate the necessity of sheeting, bracing, or pulling a trench box or shield, the cost of such sheeting, unless a special price is called for in the contract proposal form, shall be included in the contract bid price for installing water main.

3.6 DEWATERING

Water main installation shall be accomplished in a relatively dry trench. Joints shall not be connected under water. If ground water is encountered, the Contractor shall dewater the trench with suitable pumps and equipment. Lowering of the groundwater level shall be by means of wells, well points, or other suitable means.

Water resulting from the dewatering operation shall be disposed of in a manner approved by the Engineer and South Dakota Department of Environment and Natural Resources (DENR). It shall not be pumped onto private property without the property owner's approval. Any damage to property, either public or private, shall be rectified to the satisfaction of the owner and the City. If dewatering operations are expected, construction documents shall describe methods for providing temporary erosion control devices or note that a dewatering permit has been issued by the South Dakota DENR.

3.7 WATER MAIN

Water main shall be installed in the locations shown on the plans or as directed by the Engineer. Ductile iron water main shall be installed in accordance with AWWA C600 and PVC water main shall be installed in accordance with AWWA C605. Ductile iron water main shall be encased in polyethylene in accordance with AWWA C105. Water main shall not be installed in frozen ground or in water, and no water will be allowed to run into or through the pipe. Before installing water main, it shall be cleaned of all foreign matter and kept clean thereafter. Open ends shall be protected at all times to prevent the entrance of dirt, trench water, animals, or foreign matter into the pipe. The bell and spigot shall be wiped clean and sufficient lubrication placed on the gasket and spigot before the pipe is pushed fully into the bell. The lubricant shall be approved for use with potable water.

Field cut spigot ends of push-on joints shall have a square end with beveled edge equal to a factory cut prior to being pushed into the bell. Every pipe shall be bedded uniformly throughout its length with water main bedding material. Reference Standard Detail Plate 900.12 for water main bedding installation. Care shall be taken to not have any part of the pipe bearing on rocks or stones. Water main shall have a minimum of 6 feet of cover unless otherwise noted on the plans. If 6 feet of cover cannot be achieved/maintained, the Engineer shall be notified. If less than 4 feet of cover is expected, insulation shall be used to protect the water main from freezing. Cover between 4 and 6 feet will be evaluated on a case-by-case situation for insulation requirements. Whenever insulation is required for water main, individual water services should be evaluated for insulation requirements. The insulation work shall be in accordance with the special provisions, drawings, and manufacturer's recommendations.

Extra depth water main shall be installed in the locations shown on the plans or as directed by the Engineer. Extra depth water main is water main that is installed using the open cut method resulting in 8 feet or more of cover as measured from the top of pipe to the finished surface elevation. Water main installed with 6 to 8 feet of cover is considered normal depth water main installation.

3.8 VALVES AND FITTINGS

Valves and fittings shall be installed at the locations shown on the plans or as directed by the Engineer. Valves and fittings shall be installed in accordance with AWWA C600 and encased in polyethylene in accordance with AWWA C105. Valve and fitting locations shall be field verified and recorded on the as-built drawings by the Engineer. Valves and fittings shall remain exposed until the Engineer has visually inspected and measured the as-built locations.

Proper concrete blocking shall be installed under all valves. In addition, valves 12 inches in diameter and greater shall be installed with two restrainer devices per valve. A valve nut extension shall be installed on valves with more than 8 feet of cover as measured from the top of the pipe to the finished surface elevation. Gate valves in PVC water main shall be installed in conformance with Standard Detail Plate 900.08.

3.9 FIRE HYDRANTS

Fire hydrants shall be installed at the locations shown on the plans or as directed by the Engineer and in accordance with AWWA C600. The centerline of the nozzles shall be a minimum of 18 inches above the finished surface elevation. The bottom of the breakaway flange shall be 2 to 4 inches above the finished surface elevation. Fire hydrants shall be installed 2 feet behind the back of curb, stand plumb, and have their nozzles parallel with or at right angles to the street center line, with the pumper nozzle facing the street.

Flushing hydrants installed for testing purposes shall be removed once testing has been completed. If the flushing hydrants will remain in place for the duration of a winter season, they shall be installed behind proposed curb and gutter.

Hydrant leads shall be a minimum of 6 inches in diameter and have a gate valve located as close as possible to the tee. Hydrant lead valve shall be attached to the tee with $\frac{3}{4}$ -inch threaded rods. In situations where it is not appropriate to have the valve located close to the tee, the valve should be at least 30 feet from the fire hydrant. Restrainer devices will be required on all vertical bends. Hydrants shall be set on a concrete block to prevent settlement. Sufficient size concrete thrust blocks shall be installed against undisturbed soil to prevent.

Hydrant bases shall be backfilled with a minimum of $\frac{1}{3}$ cubic yard of $1\frac{1}{2}$ -inch crushed rock to facilitate drainage. The crushed rock shall extend to 6 inches above the weep hole and be covered with two layers of heavy felt paper or heavy construction plastic. Before installing the ground rod or tracer wire, the fire hydrant barrel shall be encased in polyethylene up to the ground surface. The weep holes shall not be covered by the polyethylene. A 60-inch ground rod shall be taped to the fire hydrant barrel at a

minimum of four locations and be extended to the bottom of the breakaway flange. Tracer wire shall be attached to the bottom of the ground rod. Fire hydrants and the tracer wire system shall be installed in conformance with Standard Detail Plates 900.06 and 900.07.

3.10 VALVE BOX MARKERS

Valve markers shall be installed for all valves outside of the street right-of-way that are not in paved areas unless otherwise indicated. Valve box markers shall be installed in conformance with Standard Detail Plate 900.13.

3.11 POLYETHYLENE ENCASEMENT

All buried ductile iron water main, fittings, valves, rods, and appurtenances shall be encased in polyethylene in accordance with AWWA C105, Method A. The polyethylene shall be cut 2 feet longer than the pipe section and shall overlap the ends of the pipe by 1 foot. The polyethylene shall be gathered and lapped to provide a snug fit and shall be secured at quarter points and each end with polyethylene tape.

The polyethylene shall prevent contact between the pipe and bedding material, but is not intended to be a completely airtight and watertight enclosure. Damaged polyethylene shall be repaired in a workmanlike manner using polyethylene tape or shall be replaced. The polyethylene encasement is considered to be a part of the price bid for the water main.

3.12 CONNECTIONS TO EXISTING WATER MAIN

Water main shall be connected to and extended by utilizing three different methods: removal of an appurtenance and extending, cutting in an appurtenance and extending, or smith tapping and extending. When a water main needs to be connected, a method that will minimize the interruption of service to surrounding properties should be utilized. When a connection is made utilizing methods other than smith tapping, the Contractor shall have all materials for the connection on site, and to the extent possible, shall have fittings assembled and tied prior to cutting the existing water main and making the connection. When necessary, pipe cutting shall be neat and completed in a workmanlike manner without damage to the pipe, interior lining, or exterior coating. Cutting shall be performed with an approved mechanical cutter, using a wheel cutter when applicable and practical.

When a smith tap connection is necessary, the City will furnish the tapping sleeve and valve and complete the tap. The Contractor will be responsible for excavating and backfilling the trench for completion of the tapping process and for furnishing and installed the box for the tapping valve. The trench shall be excavated in a manner so as to provide adequate shoring or bench sloping of the sidewalls of the trench prior to any work that is completed by City personnel. If the trench is considered unsafe to complete tapping operations, the Contractor will be required to provide the necessary additional work to assure safety of the trench to the satisfaction of the City tapping personnel.

3.13 SERVICE CONNECTIONS

All service connections or taps to the water main system shall be made by the City. Service taps to new or existing water mains will not be permitted until the subject water main has passed the necessary disinfection requirements as specified within this document.

3.14 TRACER WIRE

Tracer wire shall be installed with PVC and ductile iron water mains. The wire shall be installed along the lower quadrant of the pipe, but the pipe shall not be laid directly on the wire. Ground rods shall be installed adjacent to connections to existing piping and in the locations specified on the plans. The tracer wire shall be brought to each fire hydrant and connected to a 60-inch ground rod that extends up to the bottom of the breakaway flange. The ground rod shall be taped to the fire hydrant barrel in at least four locations below the ground surface. The tracer wire shall be spliced only if approved by the Engineer. All underground splices shall be inspected by the Engineer prior to backfilling. The tracer wire system is considered to be a part of the price bid for water mains.

The Contractor shall be responsible for testing the tracer wire system for conductivity. Testing for conductivity shall be completed after the service lines have been tapped. If the tracer wire system does not function as intended, the Contractor shall repair the system to the satisfaction of the Engineer. Fire hydrants and the tracer wire system shall be installed in conformance with Standard Detail Plates 900.06 and 900.07.

3.15 CONCRETE THRUST BLOCKS

The Contractor shall brace all fittings by means of poured concrete or precast concrete thrust blocks. No wood shimming or bracing will be allowed in conjunction with the concrete blocks. Poured concrete blocking shall have a compressive strength of not less than 3,000 psi. Concrete shall be poured against undisturbed earth. Care shall be taken not to cover up joints, bolts, and fittings with concrete. If a concrete thrust block cannot be poured due to poor soil condition or inadequate support for blocking, restrained joints shall be utilized. The cost for blocking is considered to be a part of the cost of the fittings. Concrete thrust blocks shall be installed in conformance with Standard Detail Plate 900.01.

3.16 BACKFILLING

Water main and service lines installed in an open trench shall be backfilled and compacted in 6-inch lifts to a height of 6 inches above the pipe. The first lift shall not exceed the springline of the pipe. Native material may be used for this portion of the backfilling in lieu of water main bedding material if approved by the Engineer. The backfill from 6 inches above the pipe to the street grade shall consist of approved excavated material. The backfill shall be placed in lifts at a depth suitable to the material encountered and compacted by methods approved by the Engineer to a density of at least 95 percent of Standard Proctor Density, unless otherwise specified.

The City will pay for the first density test taken at a given location. If the first test fails, the Contractor shall recompact the area and a second density test will be taken. If the second test passes, the City will pay for the second test. If the second test fails, the Contractor shall pay for the second test and any test taken thereafter until a passing test is obtained. This procedure will be applied to each test location. Backfill material is to be free of rock, frozen material, and hard clay. Care shall be taken in placing backfill over the crown of the pipe to avoid damage. If the material encountered in the trench excavations is unsuitable to be used as backfill material, it will be replaced or blended with select fill, as approved by the Engineer. During freezing weather, the Contractor shall remove and dispose of frozen material and replace it with a suitable fill material for water main.

3.17 DISINFECTION AND BACTERIOLOGICAL TESTING

Water main installed shall be disinfected in accordance with AWWA C651 or as directed by the Engineer. The Contractor shall place sufficient chlorine tablets or chlorine powder in the water main as it is installed. Disinfection methods and procedures are available upon request from the City Engineering Division. Once water main construction is complete, the Contractor shall request to have the pipe segment filled by City personnel. Once the pipe segment has been filled, the Contractor can begin the hydrostatic pressure testing requirements (Section 3.18).

The chlorinated water shall remain in the water main for a minimum of 24 hours. Upon completion of the minimum contact time, the Contractor shall request to have the water main flushed by City personnel. In order to prevent corrosion damage to the pipe lining, heavily chlorinated water shall not remain in contact with the water main for more than 72 hours. The water main shall be adequately flushed to remove all heavily chlorinated water and remaining particulates. City of Sioux Falls personnel shall be responsible for the dechlorination and/or disposal of heavily chlorinated water.

Once flushing is complete, City personnel will collect a water sample from an acceptable source for coliform bacteria testing. A minimum of one sample will be required for every 1,200 feet of water main installed. If the coliform bacteria test passes (coliform bacteria absent), the water main can be put into service and service lines tapped. If the coliform bacteria test fails (coliform bacteria present), the Contractor must request that the water main be reflushed and resampled. If the coliform bacteria test fails after the second attempt, the Contractor shall rechlorinate the water main by the continuous feed or slug method (liquid chlorine injection through a service tap) until the coliform bacteria test passes.

Costs for disinfecting the water main shall be included in the unit price bid for water mains.

3.18 HYDROSTATIC PRESSURE TESTING

Upon completion of the water main installation, it shall be hydrostatically tested at a pressure of 120 psi. This pressure shall be maintained for a period of two hours. The test pressure shall not vary by more than +/- 5 psi for the duration of the test. Before applying the specified test pressure, all air shall be expelled from the section of pipe being tested. The Engineer shall observe the pressure gauge readings before acceptance of the test.

New water main will have an allowable leakage equal to the amount of makeup water that must be supplied to maintain pressure within 5 psi of the specified test pressure. The allowable leakage shall not exceed the values as calculated by the following formulas:

Ductile Iron Pipe

$$L = \frac{SD\sqrt{P}}{133,200}$$

- L = testing allowance (makeup water), in gallons per hour
- S = length of pipe tested, in feet
- D = nominal diameter of the pipe, in inches
- P = average test pressure during the hydrostatic test, in pounds per square inch (gauge)

PVC Pipe

$$L = \frac{ND\sqrt{P}}{7,400}$$

- L = allowable leakage, in gallons per hour
- N = number of joints in the length of pipeline tested
- D = nominal diameter of the pipe, in inches
- P = average test pressure during the leakage test, in pounds per square inch (gauge)

Should the test disclose damaged or defective materials or leakage greater than that permitted, the Contractor shall at his own expense locate and repair and/or replace defective materials. The test shall be repeated until the leakage is within the permitted allowance. The Contractor shall furnish all pumping equipment, labor, and gauges required for the pressure test and any added costs for this test shall be included in the unit price bid for water mains.

3.19 SURFACE RESTORATION AND CLEANUP

Unless stated specifically to the contrary in the Special Information Provisions, the Contractor shall replace all surface material and shall restore paving, curb and gutter, sidewalks, fences, trees, sod, topsoil, and other items disturbed to a condition equal to that before the work began, furnishing all labor, materials, and equipment necessary to do this work. Traveled streets shall be kept open and maintained by the Contractor after backfilling and before surfacing or final inspection. The cost of all such work shall be absorbed in the unit price bid for pipe installation unless otherwise specified in the Special Information Provisions or Bid Proposal.

3.20 GENERAL

The Engineer or his/her representatives shall have access at all times to all parts of the job, and the Contractor must furnish such personnel, facilities, equipment, tools, and materials as are necessary to make whatever tests and inspection that are deemed necessary.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.1 REMOVAL OF WATER MAIN PIPE

The removal of water main shall be measured as lineal foot of pipe removed. The removal footage shall be rounded up to the nearest 1-foot increment.

The removal of water main shall be paid for at the contract unit price for each foot of water main removed. Payment for removal of water main pipe shall be full compensation for excavation, removal and disposal of the pipe, and all appurtenances necessary for proper removal.

4.2 REMOVAL OF WATER MANHOLE

The removal of a water manhole shall be measured as a unit for each manhole removed. The removal of water manhole shall be paid for at the contract unit price for each water manhole removed. Payment for the removal of a water manhole shall be full compensation for removal and disposal of the manhole, frame and cover, and all appurtenances necessary to complete the work.

4.3 ABANDONMENT OF WATER MANHOLE

The abandonment of a water manhole shall be measured as a unit for each manhole abandoned. The abandonment of a manhole shall be paid for at the contract unit price for each manhole abandoned. Payment for the abandonment of water manholes shall be full compensation for abandoning the manhole, breaking the manhole down to the required height, filling the manhole with sand, backfilling to finished grade, and all appurtenances necessary for proper abandonment of the manhole.

4.4 ROCK EXCAVATION

The excavation of rock shall be measured as cubic yards of rock removed, rounded to the nearest 0.1 increment. All rock excavation shall be under one classification. The classification shall include solid ledge rock in its natural location that requires systematic quarrying, drilling, and/or blasting for its removal and boulders 1 cubic yard in volume or greater. Pay lines for computing rock excavation shall be described as follows:

Pipe Size	Trench Width Pay Limits
Pipe diameter \leq 24 inches	4 feet
Pipe diameter $>$ 24 inches	Pipe diameter plus 24 inches

Pay lines for computing depth of the rock excavation shall be described as the distance from top of rock to 12 inches below the pipe invert elevation. The top of the rock profile will be measured and determined by the Engineer and used to determine the rock quantities.

The accepted quantities of rock excavation shall be paid for at the contract unit price per cubic yard. Payment for rock excavation shall be full compensation for permits, excavation, blasting, removal and proper disposal of the rock offsite, and all appurtenances necessary for the proper removal of the rock. Furnishing and installing suitable fill material to replace the rock removed (except in locations where bedding material is required) will be paid for with the Granular Material bid item.

4.5 WATER MAIN BEDDING MATERIAL

Water main bedding material shall be measured by the lineal foot of material furnished and installed for the respective types and sizes of pipe. Water main bedding material shall be measured from pipe end to end. The measured length shall be rounded up to the nearest 1-foot increment.

The furnishing and installing of water main bedding material shall be paid for at the contract unit price per lineal foot for the types, classes, and sizes furnished and accepted. Payment for water main bedding material will be full compensation for furnishing and installing the water main bedding material and all appurtenances necessary for the proper installation of the material.

4.6 TRENCH STABILIZATION MATERIAL

The furnishing and installing of trench stabilization material shall be measured as cubic yards of trench stabilization material to the nearest 0.1 ton. The accepted quantities of furnished and installed trench stabilization material will be paid for at the contract unit price per ton. Payment for trench stabilization material will be full compensation for furnishing and installing the trench stabilization material, excavation, removal and disposal of unstable soils, and all appurtenances necessary for the proper installation of the material.

4.7 SELECT FILL FOR WATER MAIN

The furnishing and installing of select fill for water main shall be measured as tons of select fill for water main material to the nearest 0.1 ton. The accepted quantities of furnished and installed select fill for water main will be paid for at the contract unit price per ton. Payment for select fill for water main will be full compensation for furnishing and installing the select fill for water main and all necessary work for the proper installation of the material.

4.8 WATER MAIN INSULATION

Water main insulation shall be measured by the lineal foot of the pipe length that is insulated and for different sizes of insulation.

The measured length shall be rounded up to the nearest 1-foot increment.

The furnishing and installing of water main insulation shall be paid for at the contract unit price per lineal foot for the sizes furnished and accepted. Payment for water main

insulation will be full compensation for furnishing and installing the insulation and all appurtenances necessary for the proper installation of it.

4.9 WATER MAIN

Water main shall be measured by the lineal foot for the respective types, classes, and sizes of pipe. Pipe shall be measured from center to center of fittings or to the end of pipe. The measured length shall be rounded up to the nearest 1-foot increment. The furnishing and installing of water main shall be paid for at the contract unit price per lineal foot for the types, classes, and sizes furnished and accepted. Payment for water main will be full compensation for furnishing and installing the water main pipe, gaskets, trench dewatering (unless otherwise specified), excavating and backfilling, and all appurtenances for the proper installation of water main.

4.10 EXTRA DEPTH WATER MAIN

Extra depth water main shall be measured by the lineal foot for the respective types, depths, classes, and sizes of pipe. Piping shall be measured from center to center of fittings or to the limits of pipe installed at extra depth as defined previously. The measured length shall be rounded up to the nearest 1-foot increment.

The furnishing and installing of extra depth water main shall be paid for at the contract unit price per lineal foot for the types, depths, classes, and sizes furnished and accepted. Payment for extra depth water main will be full compensation for furnishing and installing the extra depth water main pipe, gaskets, trench dewatering (unless otherwise specified), excavation, backfilling, and all appurtenances for the installation of extra depth water main to the depths as described in project plans and specifications.

4.11 VALVES AND BOXES

Valves and boxes shall be measured as each unit of respective type and size. The furnishing and installing of valves and boxes shall be paid for at the contract unit price per each for type and size furnished and accepted. Payment for valves and boxes will be full compensation for furnishing and installing the valve, box, gaskets, bolts, operator, excavating, backfilling, blocking, dewatering, and all appurtenances necessary for proper installation of the valves and boxes.

4.12 WATER MAIN (INSTALL ONLY)

Water main for installation only shall be measured by the lineal foot for the respective types, classes, and sizes of pipe. Piping shall be measured from center to center of fittings or to the end of the pipe. The measured length shall be rounded up to the nearest 1-foot increment. The installed water main shall be paid for at the contract unit price per lineal foot for the types, classes, and sizes installed and accepted. Payment for water main installation will be full compensation for installing the water main pipe, furnishing and installing the new gaskets, trench dewatering (unless otherwise specified), excavating, backfilling, and all appurtenances for the proper installation of the water main.

4.13 MECHANICAL JOINT FITTINGS

Mechanical Joint (MJ) Fittings shall be measured as each unit of respective type and size. Fittings include elbows, tees, reducers, crosses, plugs, and sleeves. The furnishing and installing of MJ fittings shall be paid for at the contract unit price per each for the types, classes, and sizes installed and accepted. Payment for MJ fittings will be full compensation for furnishing and installing the MJ fittings, gaskets, trench dewatering (unless otherwise specified), excavating, blocking, backfilling, and all appurtenances for the proper installation of MJ fittings.

4.14 FIRE HYDRANT

Fire hydrants shall be measured as each unit. The furnishing and installing of fire hydrants shall be paid for at the contract unit price per each for type furnished and accepted. Payment for fire hydrants will be full compensation for furnishing and installing the hydrant, gaskets, blocking, excavating, backfilling, and all appurtenances necessary for proper installation of the fire hydrant.

4.15 REMOVE AND SALVAGE FIRE HYDRANT

The item for remove and salvage fire hydrant shall be measured as a unit for each hydrant that has been removed and salvaged. The removal and salvage of fire hydrants shall be paid for at the contract unit price per each for the locations indicated on the project plans and specifications. Payment for removal and salvage of fire hydrants shall be full compensation for excavation, disconnection, removal, salvaging to designated location, and all necessary appurtenances for proper completion of the work item.

4.16 REMOVE AND RELOCATE FIRE HYDRANT

The item for remove and relocate fire hydrant shall be measured as a unit for each hydrant that is removed and relocated. The removal and relocation of fire hydrant shall be paid for at the contract unit price per each for the locations indicated on the project plans and specifications. Payment for removal and relocation of fire hydrant shall be full compensation for excavation, disconnection, reconnection, removal, relocation to designated location, blocking, and all necessary appurtenances for proper completion of the work item.

4.17 FIRE HYDRANT EXTENSION

The item for fire hydrant extension shall be measured as a unit for each respective size and type of extension. The fire hydrant extension shall be paid for at the contract unit price per each for the locations, types, and sizes indicated on the project plans and specifications. Payment for fire hydrant extension shall be full compensation for the extension, removal and reinstallation of the top section of the fire hydrant, and all necessary appurtenances for proper completion of the fire hydrant extension.

4.18 TEMPORARY FIRE HYDRANT

Temporary fire hydrants shall be measured as a unit for each respective hydrant required. The temporary fire hydrant shall be paid for at the contract unit price per each for the locations, types, and sizes indicated on the project plans and specifications. Payment for temporary fire hydrant shall be full compensation for the temporary fire hydrant, excavation, gaskets, connection, subsequent removal, backfilling, and all necessary appurtenances for proper completion of the temporary fire hydrant.

4.19 COMBINATION AIR VALVE MANHOLE

Combination air valve manholes shall be measured as a unit for each respective manhole required. The combination air valve manhole shall be paid for at the contract unit price per each for the locations, types, and sizes indicated on the project plans and specifications. Payment for combination air valve manhole shall be full compensation for precast manhole, concrete footings, $\frac{3}{4}$ -inch crushed rock, excavation, backfill, frame and cover, gaskets, valves, and all necessary appurtenances for proper completion of the air release manhole.

4.20 SMITH TAP AND BOX

Smith tap and box shall be measured as a unit for each respective size and type required. Payment for smith tap and box shall be paid for at the contract unit price per each for the locations, types, and sizes indicated on the project plans and specifications. Payment for smith tap and box will be required on noncapital improvement projects and shall be full compensation for the City furnishing the tapping sleeve and valve and completing the tap and the Contractor excavating, backfilling, furnishing and installing the valve box, and all necessary appurtenances for proper completion of the smith tap and box installation. The tapping sleeve and valve and the labor necessary to complete the smith tap and box installation are provided by the City; however, the Contractor must compensate the City for the work (materials and labor) if the work is noncapital improvement related.

4.21 WATER MAIN ADJUSTMENT

Water main adjustment shall be measured as a unit for each respective size and type of adjustment completed. The water main adjustment shall be paid for at the contract unit price per each for the types, classes, and sizes of water main adjusted. Payment for water main adjustment shall be full compensation for excavating, dewatering of the water main and trench, additional time required for the installation of materials, backfilling, and all necessary appurtenances for proper completion of the water main adjustment. **Note: All materials required for the water main adjustment are paid for under their respective bid item. Water main adjustment is considered as additional pay required to complete the adjustment.**

4.22 CONNECT TO EXISTING WATER MAIN

Connect to existing water main shall be measured as each unit connection. The connection to existing water main shall be paid for at the contract unit price per each for the connection to existing water mains for the purpose of extending an existing water main. Payment for connection to existing water main shall be full compensation for excavating, backfilling, dewatering of the water main and trench, removing the plug or hydrant, and all necessary appurtenances for proper completion of the connection to existing water main.

4.23 CUT AND TIE TO EXISTING WATER MAIN

Cut and tie to existing water main shall be measured as a unit for each respective connection made. Payment for cut and tie to existing water main shall be at the contract unit price per each for cutting and tying to existing water main. Payment for cutting and tying to existing water main shall be paid for at the contract unit price per each for the locations indicated on the project plans and specifications. Payment for cutting and tying to existing water main shall be full compensation for excavating, backfilling, dewatering of water main and trench, cutting water main, tying to water main, and all necessary appurtenances for proper completion of the cutting and tying work item. **Note: All materials required for the connection to the existing water main shall be paid for separately under their respective bid items.**

4.24 VALVE BOX ADJUSTMENT

Valve box adjustment shall be measured as each unit adjusted. The valve box adjustment shall be paid for at the contract unit price per each for the valve boxes adjusted. Payment for valve box adjustment shall be paid for at the contract unit price per each for the locations indicated on the project plans and specifications. Payment for valve box adjustment shall be full compensation for adjusting the valve box to the desired finished grade as indicated on the project plans and specifications and all necessary appurtenances for proper completion of the valve box adjustment. Valve box adjustment will only be paid for once per valve per project.

4.25 VALVE BOX EXTENSION OR REPLACEMENT

Valve box extension and replacement shall be measured as each unit extended or replaced. The furnishing and installing of valve box extensions or replacements shall be paid for at the contract unit price per each installed and accepted. Payment for valve box extension or replacement shall be full compensation for furnishing and installing valve box extension or replacement, excavating, backfilling, and all necessary appurtenances for proper completion of the valve box extension or replacement.

4.26 WATER SERVICE TRENCH

Water service trench shall be measured by the lineal foot. The measurement length shall be rounded to the nearest 1-foot increment. An additional 3 feet shall be added to the length of water service installed to account for the excavation required around the water main connection and at the curb stop connection point.

The water service trench shall be paid for at the contract unit price per lineal foot of excavated and backfilled water service trench. Payment for water service trench shall be paid for at the contract unit price per lineal foot at the locations indicated on the project plans and specifications. Payment for water service trench shall be full compensation for excavating, backfilling, and all necessary appurtenances for proper completion of the water service trench excavation and backfill.

4.27 WATER SERVICE RECONNECT

Water service reconnect shall be measured by each unit of respective size and type. The water service reconnect shall be paid for at the contract unit price per each excavated and backfilled trench. The City shall complete all water service reconnections. Payment for water service reconnect trench excavation and backfill shall be paid for at the contract unit price per each at the locations indicated on the project plans and specifications. Payment for water service reconnect shall be full compensation for excavating, backfilling, coordination with City, and all necessary appurtenances for proper completion of the water service reconnection.

4.28 WATER MAIN BYPASS PIPE

Water main bypass pipe shall be measured by the lineal foot for the respective types, classes, and sizes of pipe. Piping shall be measured from end to end with no deduction for length through fittings. The measured length shall be rounded up to the nearest 1-foot increment.

The furnishing and installing of water main bypass pipe shall be paid for at the contract unit price per lineal foot for the types, classes, and sizes furnished and accepted. Payment for water main bypass pipe shall be full compensation for furnishing and installing the bypass piping, pressure testing, bacteria testing, and all necessary appurtenances for proper completion of the water main bypass piping.

4.29 PRECAST WATER METER VAULT WITH CASTING

Precast water meter vault with casting shall be measured by each unit of the respective type, class, and size of vault constructed. The furnishing and installing of precast water meter vault with casting shall be paid for at the contract unit price per each for the types, classes, and sizes furnished and accepted. Payment for water meter vault with casting shall be full compensation for excavation, drain rock, subgrade preparation, precast vault, backfilling, gaskets, rubber rope sealant, casting, and all necessary appurtenances for proper completion of the water meter vault with casting.

4.30 CLEAN AND LINE WATER MAIN

Clean and line water main shall be measured by the lineal foot for the respective types, classes, and sizes of cleaned and lined water main. The pipe shall be measured along the centerline of the pipe without deduction for valves and fittings. The measured length shall be rounded up to the nearest 1-foot increment.

The cleaning and lining of water main shall be paid for at the contract unit price per lineal foot for the types, classes, and sizes cleaned and lined in accordance with the specifications, and accepted. Payment for cleaning and lining water main shall be full compensation for dewatering the water main, cutting and opening the pipe, mechanically cleaning the interior of the pipe, lining the pipe with cement mortar, replacing and coupling all open pipe, sterilizing and thoroughly flushing the lined pipes, and all necessary appurtenances for proper completion of the water main cleaning and lining.

4.31 ABANDONMENT OF VALVES

Abandonment of valves shall be measured by each unit of respective type, class, and size of valve abandoned. The abandonment of valves shall be paid for at the contract unit price per each for the types, classes, and sizes abandoned in accordance with the specifications, and accepted. Payment for abandonment of valves shall be full compensation for removing the top section of the valve box, top 2 feet of manhole (if applicable), select fill material to fill the remaining section of valve box, and all necessary appurtenances for proper completion of the abandonment of valves.

4.32 RESTRAINER DEVICES

Restrainer devices shall be measured by each unit of respective type, class, and size. Furnishing and installing restrainer devices shall be paid for at the contract unit price per each for the types, classes, and sizes installed in accordance with the specifications, and accepted. Payment for restrainer devices shall be full compensation for excavation, restrainer device, gaskets, and all necessary appurtenances for proper completion of restrain device furnish and installation.

4.33 VALVE BOX MARKER

Valve box markers shall be measured by each unit furnished and installed.

The furnishing and installing of manhole markers shall be paid for at the contract unit price per each furnished and accepted. Payment for valve box markers will be full compensation for furnishing and installing the valve box markers and all necessary appurtenances for the proper installation of the valve box markers.

4.34 JACKING, BORING, AND TUNNELING

The basis of measurement shall be by the lineal foot for casing pipe and carrier pipe. The measured length of carrier pipe and casing pipe shall be rounded up to the nearest 1-foot increment.

Furnishing and installing of casing pipe and carrier pipe shall be paid for at the contract unit price per lineal foot for the types, classes, and sizes furnished and installed in accordance with the specifications, and accepted. Furnishing and installing end seals and casing spacers shall be considered incidental to the installation of the carrier pipe. Payment for casing pipe will be full compensation for furnishing and installing of the casing pipe by boring, jacking or tunneling, excavating and backfilling of bore pits, welding, trench dewatering (unless otherwise specified), and all necessary appurtenances for proper installation of casing pipe.

Payment for carrier pipe will be full compensation for furnishing and installing of the carrier pipe, gaskets, and all other appurtenances necessary for the proper installation of the carrier pipe.

Payment for boring obstruction will be full compensation for the labor, equipment, and materials needed for removal of the obstruction. Payment for boring obstructions will be paid only for boring obstructions with mechanical equipment. If the project work is performed by a hand-mining operation, all such obstructions will be considered part of the normal operation and will not be paid for as a boring obstruction.

A boring obstruction shall be defined as any rock, boulder, etc., or similar material, which is encountered during the excavation that cannot be removed by the boring machine and requires shutdown of the equipment for removal. The Contractor shall be aware that all quantities are estimates and that there may be no obstructions or could be a large number of obstructions on the project. The Contractor will only be paid for obstructions encountered and reported to and verified by the Engineer. The bid item quantities are not guaranteed items.

4.35 WATER SERVICE DISCONNECT

Water service disconnects shall be measured by each service trench excavated and backfilled to disconnect a water service line. The trench shall be excavated so that the City of Sioux Falls Water Department can complete the disconnect. If more than one service can be disconnected in any one trench, then only one water service disconnect payment will be made.

The water service disconnect shall be paid for at the contract unit price per each trench excavated and backfilled. Payment for water service disconnect shall be paid for at the contract unit price per each at the locations indicated on the project plans and specifications. Payment for water service disconnect shall be full compensation for excavating, backfilling, and all necessary appurtenances for proper completion of the water service disconnect trench excavation and backfill.

4.36 WATER SERVICE SETBACK

Water service setbacks shall be measured by each service trench excavated and backfilled to setback a water service curb stop box. The trench shall be excavated so that the City of Sioux Falls Water Department can complete the curb stop setback. If more than one service can be setback in any one trench, then only one water service setback payment will be made.

The water service setback shall be paid for at the contract unit price per each trench excavated and backfilled. Payment for water service setback shall be paid for at the contract unit price per each at the locations indicated on the project plans and specifications. Payment for water service setback shall be full compensation for excavating, backfilling, and all necessary appurtenances for proper completion of the water service setback trench excavation and backfill.